PROJECTIONIST

INTERNATIONAL

MARCH 1952

VOLUME 27 • NUMBER 3

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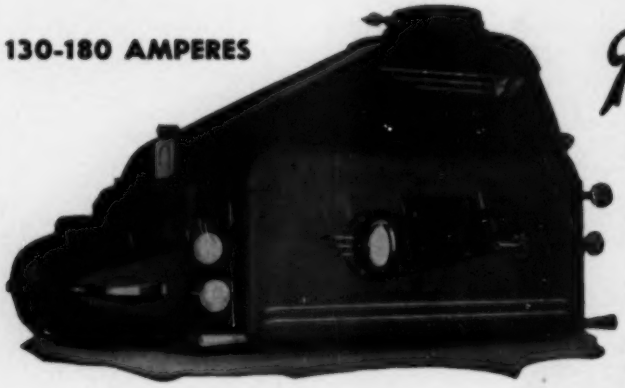

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Harry Sherman

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While always fearless in his judgment of men and issues, Brother Sherman had a capacity for warm fellowship which resulted in wide popularity throughout his career.

We of the General Office were shocked and saddened by his death.

Richard F. Walsh

International President.

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INTERNATIONAL PROJECTIONIST

With Which Is Combined PROJECTION ENGINEERING

JAMES J. FINN, *Editor*

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HARRY SHERMAN

HARRY SHERMAN, labor editor of this publication and conductor of its "In the Spotlight" department, died at the age of 57 on March 3rd after a brief illness.

Harry Sherman was known to thousands of IA members. He was formerly assistant to the International president, and president of Local 306, New York. His multitudes of friends in the International helped him and smoothed his path in his task as labor editor; he won those friends, and the respect and regard of thousands more who did not know him personally, during his many years of avid championship of the working man's interests, his forthright and unremitting endeavors in behalf of the members of his chosen craft.

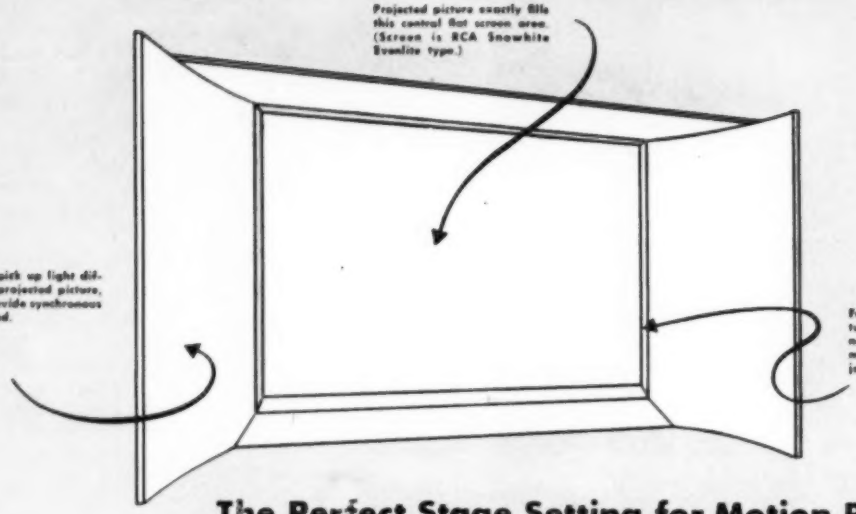
He was an "old-timer" even among old-timers, for he first joined Local 306, New York, in the year 1911. His fellow-members repeatedly elected him to office in various capacities. Following a period of service as IA representative he was named assistant IA president by the then International President William F. Canavan, in 1925. Between 1926 and 1932 he worked to better labor-management relations in the post of labor relations director for Publix Theatres Corporation, a subsidiary at that time of Paramount Pictures; resigning from that post when elected president of Local 306.

His zeal for the interests and welfare of his fellow craftsmen increased through those years of service during which he developed from a labor leader to a labor statesman, seeing the broader rather than the narrower view of the endless complexities in the ever-shifting relationship between production and direction—management and labor. His deeply reasoned and incisive conclusions were often presented with vigorous effect before International Conventions and his own Local's meetings, and played a strong part in winning him his hosts of friends.

Harry Sherman was a Past Master of Dirigo Lodge, F. & A. M., an Active Member of the Society of Motion Picture and Television Engineers, Member of the 25-30 Club of New York and of the Theatrical Square Club.

Surviving him are his wife, Ruth; two daughters, four grandchildren and three brothers.

Announcing...RCA's new Synchro-Screen


Projected picture exactly fills this central flat screen area. (Screen is RCA Snowhite Everlite type.)
Side wings pick up light diffused from projected picture, and thus provide synchronous light surround.
Fuzzy edges of projected picture are trimmed off by these narrow areas, which are almost perpendicular to projected light.

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Read what patrons say:

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- **"Easier on the eyes"**
- **"Picture looks bigger"**
- **"Better color"**
- **"Old black masking seemed morbid; this new screen seems more cheerful."**

New maskless screen fits most theatres . . . surrounds picture with frame of synchronized light effects . . . adds new beauty and realism . . . reduces eye-strain and fatigue.

TYPICAL COMMENTS from typical theatre patrons seeing the RCA Synchro-Screen for the first time . . . at the Plaza in New York City, at the Plaza in Scarsdale, N. Y. . . . at the Cinema in Framingham, Mass. Right from the start people have been almost unanimous in their enthusiastic approval.

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Picture seems larger

Synchro-Screen has effect of extending picture beyond limits of flat screen and out onto broad wings . . . makes picture seem larger, less confined. Particularly effective with color film because wings pick up not only intensity of picture light but also color. Results are truly beautiful.

Synchro-Screen package fits most theatres

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*The RCA Synchro-Screen employs Firestone Velon of RCA specification.

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VOLUME XXVII MARCH 1952 NUMBER 3

Better Film Care Improves Entertainment

The projectionist is part of an industry that is threatened both by home Tv and by shortage of film stock. Every projectionist can help this industry provide better entertainment by making sure film is not damaged in *his* projection room. Doing this also minimizes the threat of film stock shortage. Eastman Kodak Company has prepared a very useful and authoritative set of reminders to refresh the memories of all concerned. IP is glad to reproduce here a condensed version of Eastman's remarks concerning care of film in the theatre, and will in a future issue present a similar condensation of the same company's advice to exchanges.

GOOD projection, which adds patronage and increased revenue to the theater, is entirely dependent on the skill of the projectionist and the condition of the film and the projector. Satisfactory screen reproduction is not possible with a bad print regardless of how efficient the projectionist may be. Likewise, good results with a perfect print cannot be expected from faulty projection equipment. Through constant use, projector parts become worn and out of adjustment. The replacement of worn or damaged parts when needed represents a wise investment because any expenditure in this direction will improve projection and materially reduce unnecessary film damage.

While the maintenance of the projection equipment is the ultimate responsibility of the theater, the projectionist can do many things which will aid in eliminating print damage. There are, for example, various projector parts which demand frequent attention on the part of the projectionist. Film damage may occur at any one of them and may often be avoided if adjustments are made at the proper time and if damaged or worn parts are not only discovered but replaced promptly.

The following résumé covers the more important points which must be given careful attention by the projectionist if the maximum wearing qualities are to be obtained from the film.

Magazine Valve Rollers

It should be remembered that severe abrasion is often the only reason for discarding a print. It is probable that more film is scratched in the magazine valve rollers than at any other part of the projector. This is especially true for those rollers in the upper assembly, the first point of contact with the film after it leaves the feed roll. At this point, dirt, oily matter and film chips may accumulate so as to prevent free turning of the rollers or they may become so clogged that one or more of the rollers may not turn at all. The roller tracking may also develop flat spots and wear down to the point where the center of a non-turning roller is in direct contact with the film. Under these conditions, the relatively soft emulsion of a new print is very susceptible to abrasion and the scraping is frequently so deep that the emulsion is completely plowed off. Support-side scratches show up as dark lines on the screen and might be equally disturbing, particularly when they become filled with oil and dirt. With duplitized film (certain types of color prints), there are two emulsions to be damaged. Most projectionists are familiar with the objectionable red and green "rain," or deeper scratching on some of the duplitized films.

Both straight scratches, and those that weave slightly in a repeating pattern caused by uneven reel flanges moving the film from side to side, can be created in the valve rollers, although the perfectly straight abrasions are more often associated with some guided position.

Padding of Trap Doors

Occasionally release prints are encountered which give a slight flutter in the gate or trap. This produces some in-and-out-of-focus effect on the screen. In an effort to control this flutter, projectionists have been known to fasten strips of pressboard, velvet, or layers of tape between the tension pads, both above and below the aperture, thereby discouraging any forward motion of the film. This practice can cause serious support-side abrasion, particularly in the case of films having a higher positive curl than usual. Increased curl is a common condition with newer prints during dry winter months.

Abrasion Due to Positive Curl

In the case of prints having higher positive curl there is always a possibility of support side abrasion at some other point which is normally not contacted by flat film. Attention has already been

drawn to the importance of making sure that the valve rollers turn freely. Another place at which contact may occur is at the intermittent guide holder. On some projectors the center clearance at the intermittent guide holder is not great enough for films with high positive curl. Some projectionists have filed this center section to increase the clearance. This is a satisfactory solution to the problem if it is very carefully done and the surface is polished to satin smoothness after filing. If any file marks remain, however, there is the chance that these can cause even more severe damage than that caused by the holder in its original condition.

Another method which has been used successfully by a number of projectionists but which is possible only on certain makes of projectors, is to raise the lower loop slightly by threading *over* the first pad roller and *under* the second roller. When this is done, it may be necessary to readjust the rollers in such a way that there is sufficient clearance at the second roller for two thicknesses of film. This alternate threading procedure permits the film to flow onto the sprocket from the intermittent loop more easily and with less plopping of the loop than is the case when the film is threaded in the conventional manner.

Signalling Devices

Signalling devices contained in the film supply magazine which employ a small ball or roller, which rides on the emulsion side of the film, should be checked frequently for binding or wear. Such devices in poor operating condition could prove harmful, particularly on a new print when the emulsion is most susceptible to damage.

New Print Sticking

While a new print is assumed to be ready for projection, the projectionist might encounter sticking on first runs resulting from insufficient lubrication of the print. This is commonly referred to as "green print" trouble. The gelatin in freshly developed emulsion retains a considerable amount of moisture and is readily affected by heat, which makes it soft and tacky. The first point at which new film comes in contact with high temperature is at the aperture of the projector. Here the heat may soften the gelatin and causes it to collect on the tracks or shoes at either side of the aperture or at a point slightly above or below this level. It rapidly dries to a bone-like hardness.

As the new film is projected, this hard deposit continues to accumulate and offers further resistance, which may result in deep rub lines, usually along the line of perforations or in the area between the row of perforations and the edge of the film. As this resistance increases, there is the added danger of the teeth of the intermittent sprocket seriously damaging the perforations, sometimes to such an extent that the print is beyond repair.

When print sticking occurs, prompt action is necessary. Some projectionists

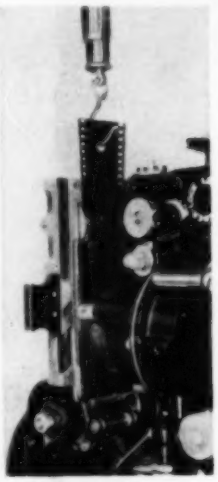


FIGURE 1

Recommended method of measuring gate tension.

apply oil in generous amounts to eliminate the trouble. This is undesirable. Such application covers the picture area of the film where no oil is needed and seriously impairs the quality of the projected image. A very small amount of oil on the thumb and finger, applied at intervals to the perforation area (alternating from one side to the other), before the film enters the trap or gate is all that is needed to work the film through. At the end of the run, the tracks can be cleaned to remove any remaining hardened deposit. This should be done with a damp cloth or if necessary, a copper coin—never with a hard metal such as a screw driver, knife or razor blade. A scraper fashioned from a toothbrust handle, is a handy implement for this purpose. It must be remembered that deposits will

FIGURE 2

Spring balance for measuring gate tension. Range 6 to 16 ounces.

form more readily once the highly polished metal surfaces are scratched.

Guide Rollers

The guide rollers located above the gate or trap serve as a guide for the film as it passes down past the aperture to the intermittent sprocket. If these rollers are out of line with the sprocket, the teeth will engage the film perforations off center, and the sides of the perforations may often become broken. Also, if the rollers do not turn freely, they will eventually develop ridges which may roughen the edges of the film, particularly if the film is old and brittle. These ridges, if deep enough, may even loosen the corners of poor splices. The guide roller assemblies should be inspected frequently and, if necessary, removed for thorough cleaning. The guide roller tension springs should be checked occasionally to see that they have not become so weak that proper tension is not maintained. Weak springs might allow sidewise unsteadiness, particularly with a fluttering oversize loop.

Sprocket Pad Rollers or Idlers

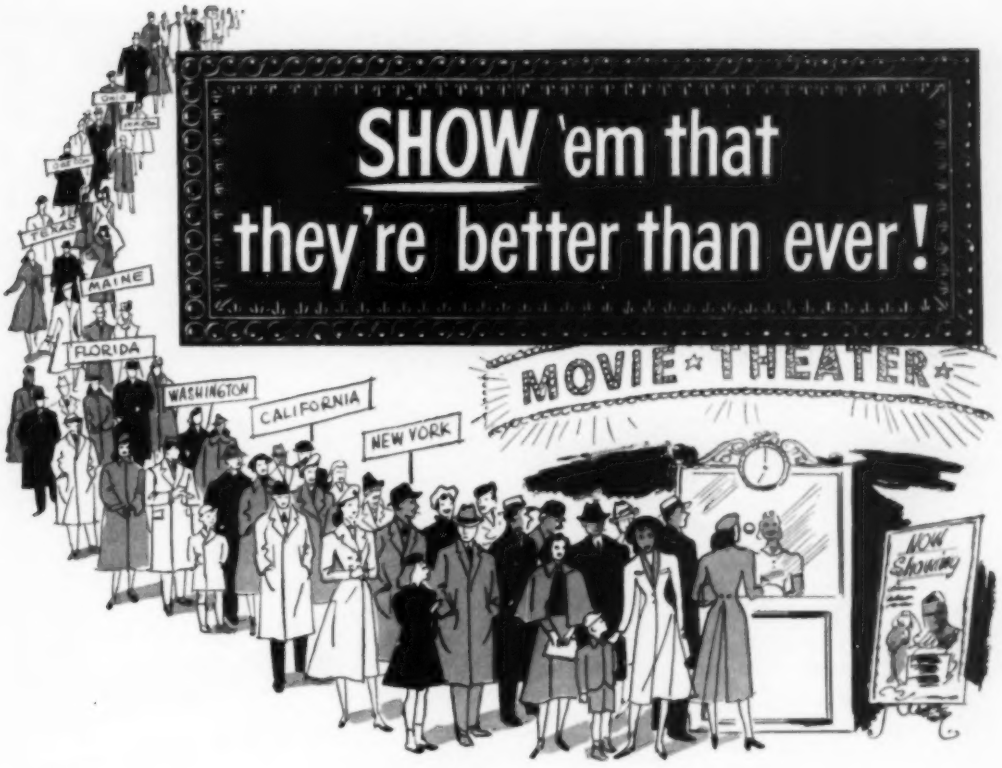
Sprocket pad rollers or idlers are frequently set too close to the sprocket so that they ride the film and cause marking and creasing. If they bind on the shaft, rubbing will occur at the side of the picture or possibly into the sound track area, particularly in the case of new prints. Such rub marks in the sound track area can seriously impair the sound reproduction quality. They generally cause frying noises and any picked-off spots which occur at regular intervals will result in "motorboating," although it is also true that the latter effect might often be caused by a printing defect.

If roller spacing is too great, the film may jump the sprocket, especially at a stiff splice. The generally accepted setting is at the point where the idler can still turn freely with two layers of standard thickness film on the sprocket. To insure free turning, the rollers should be removed occasionally so that the shaft can be cleaned of any gummy deposit, then lubricated slightly. On reassembling and resetting, it is important to make certain that there is no binding between the roller and sprocket teeth. It is also advisable to check the lock nut on the adjusting screw periodically.

Trap or Gate Tension

One of the principal sources of film damage is excessive tension exerted on the film by the springs in the gate or trap. Some projectionists judge the tension by merely pressing on the pads, checking one side, then the other. As far as is known, there seems to be no generally accepted standard setting for any given projector. The results of tests made in the Kodak Research Laboratories on various projectors and over a long period of time, indicate that complete, equalized trap tension in excess of 16 ounces is unnecessary and only

(*Continued on page* 11)



Adequate projection lighting is the only thing you need add to what Hollywood is already doing to "show" the movie-going public that movies are *better than ever.* The talent, direction, settings, the fidelity of color and detail are all ON THE FILM. Your projection lighting determines how much of that excellence is translated TO YOUR SCREEN . . . how much of it your customers SEE . . . how much more of it they will WANT and BUY.

SHOW 'EM IT'S MOVIETIME...
GIVE 'EM THE LIGHT TO SEE!

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- **Screen Light Distribution?**
- **Screen Reflectivity?**
- **Color of light?**
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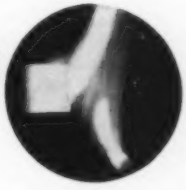

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MAKE "A" ..... Present screen—Not being made yet
MAKE "C" ..... Present screen—Not a direct system, requires film processing
MOTIOGRAPH ..... 24 FEET
MAKE "B" ..... 24 FEET
MAKE "E" ..... 20 FEET
MAKE "G" ..... 20 FEET
MAKE "H" ..... 14 FEET
MAKE "F" ..... 13 FEET
AS TO MAXIMUM THROW
MAKE "A" ..... Equal of a projector—Not being made yet, not an instantaneous or direct system. Requires film processing
MAKE "D" ..... Equal of a projector—Not a direct system. Requires film processing
MAKE "C" ..... Limit of a 16 MM projector—Not a direct system. Requires film processing
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increases the wear on the film, while settings as low as 6 ounces appear, in some instances, to be sufficient to give a steady screen image. It would seem from these tests that the tension should fall somewhere within the range from 6 to 16 ounces.

The proper pressure will, of course, depend upon the projector used, the length of time it has been in service, and the type of surface treatment the film has received. The projectionist does not usually know what the tension might be for his projector, since he is not ordinarily faced with the necessity of checking it when the equipment is in a smooth-running condition. He should, however, be familiar with the method of measurement.

Tension Testing

The proper method of making a tension test is illustrated in Figure 1. To determine the total trap tension, a full width piece of reasonably new film of standard thickness and free from oil is placed in the trap or gate of the projector. The test should be made on a *cold* projector to insure uniformity. Care should be taken to see that the perforations are not engaged by the intermittent sprocket teeth and that the film is held properly in place by the tension shoe before proceeding. Using a small, graduated spring balance, such as the one illustrated in Figure 2, which has been fastened to the film, an upward pull should be exerted slowly until the film just starts to move. If the film appears to stick at the start it should be moved slightly and the operations should be repeated. If the tension is found to be above 16 ounces, the tension should be reduced so that it falls within the range from 6 to 16 ounces, preferably near the lower end of the range. The projector should then be checked for steadiness of the screen image.

Tension Adjustment

Tension adjustment on the newer type projectors has been greatly simplified. Centralized pressure exerted on the pads by cone-shaped springs has eliminated practically all of the difficulties previously experienced with double-pronged finger-type springs. Vertical unsteadiness may often be traced to an accumulation of dirt at the base of the intermittent sprocket teeth, rather than to low trap tension. Bands on new prints from the exchange usually carry a sticker, noting that it is a new print or that the tension should be reduced, but in the case of many older type projectors still in use, this means that the double-pronged springs would have to be removed and bent by hand. These springs would have to be bent back again for use with older film. Since they were never intended to stand such repeated bending, it is advisable to adjust them to give the minimum tension which will give reasonably good steadiness with all prints.

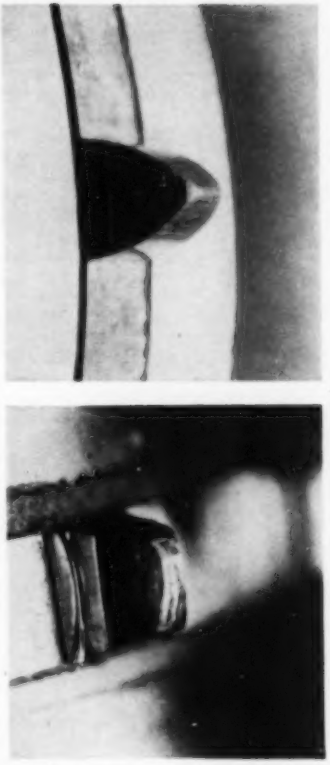


FIG. 3. New sprocket tooth (above) in perfect condition, and (below) normally worn tooth on sprocket that is still in serviceable condition.

Tension on Upper Magazine Shaft

Proper adjustment of the spring tension on the feed spindle is important. If set too loosely, the film may come from the feed roll with a jerky motion. This is especially noticeable when the roll is loosely wound or if a bent reel is used, and is particularly bad for film in a noticeably worn or dried out condition. If the tension is too tight, the pull on the last forty or fifty feet might be sufficient to cause serious perforation breakage, more so if a small-hubbed reel is used. It is not at all uncommon to lose the upper loop or for the film to break under this strain.

Intermittent Film Guide

Considerable sprocket and film damage may be attributed to improper setting of the intermittent film guide or shoe, the intended purpose of which is to hold the film snugly against the sprocket. The older type of guide holder can easily become sprung if excessive upward pressure is applied in attempting to remove a snug-fitting trap door from the older type holder. When replacing such a door or plate, care should be taken to see that it is seated properly, otherwise the sprocket may be badly damaged.

A loose-fitting holder should also be repaired, since this might allow the sprocket teeth to strike the inside walls of the guide due to the slightest side motion. It has been common practice to deliberately bend the older type guide holder by hand, either to insure better contact of the film with the sprocket, or to eliminate the "clicking" due to contact with the teeth. Improved design and construction and the two-stud trap door locking arrangement on newer projector models has greatly reduced the possibility of trouble from this source.

Some projectionists prefer to use a light guide spring, since they claim it is easier on the film and allows stiff splices to pass with less effort. Others insist that heavier pressure at this point gives a steadier picture, even though the trap tension might be lower than usual. Instances have been noted where two of the newer cone-type springs were nested together and used as a single spring in order to obtain heavier pressure against the film at the sprocket. It is obvious, however, that if the pressure at this point is unnecessarily high, the film wear will be greater and the sprocket may become rimmed in a short time.

Bad Sprockets

It is highly unfortunate that intermittent sprockets are frequently kept in service until they develop pronounced cuts or become otherwise so badly worn as to cause serious perforation damage. This is particularly true if the trap tension is excessive or if poor guiding allows the bad teeth to strike the perforations noticeably off center. Although present day sprockets are hardened in order to give longer service, they do not endure forever. Yet sprockets are often kept in use after the teeth have become so badly damaged that pieces of film are torn from the pull-down edges of the perforations. Even the lesser flaws in worn sprockets result in noisy operation, since they prevent the film from leaving the sprocket freely.

Sprocket teeth which have knife-like edges resulting from contact with the inside walls of the metal guide, cause the small straight cuts parallel to the edge of the film, extending downward from the pull-down edges of the perforations and well in from the corners. These small cuts quickly develop into more serious damage which can soon result in complete breakdown. Figure 3 shows a

(*Continued on page* 12)

FIG. 4. Severe conditions of wear found on theatre sprockets that had been kept in service after they were no longer serviceable.

new tooth and the typical slightly curved face cut commonly seen on normally worn sprocket teeth. Figures 4 and 5 illustrate the more severe conditions of wear found on sprockets that had been kept in theatre service far too long.

0.943-Inch Base Diameter Sprockets

A great deal of work has been done by the motion picture industry which has shown that the projection life of film is considerably prolonged if the intermittent sprocket is at least as large or larger than the size required to give perfect mesh of the sprocket with the film being driven. Obviously, the conditions for perfect mesh of the film with the sprocket are intimately associated with the shrinkage of the processed film. In recent years, the shrinkage characteristics of motion picture films have been greatly improved, so that a sprocket of greater base diameter is now preferable to the 0.935-inch base diameter intermittent sprockets previously accepted.

In 1947, an intermittent sprocket having a 0.943-inch base diameter was approved by the Society of Motion Picture Engineers and the American Standards Association. Careful laboratory tests as well as comparative tests in many theaters over several years have shown that this new sprocket gives longer film life and less sprocket wear than the older 0.935-inch base diameter sprocket. The new sprockets are now being supplied as regular equipment by a few projector and parts manufacturers and it is expected that the new standard will soon be accepted universally.

Even the new sprocket does not fit present day low shrinkage films perfectly but it does approach this desirable condition. It has been chosen as the best available within the limits of designs that have been proven by extensive trade usage. It is, however, quite possible that further work and further improvements in film may suggest a still larger diameter sprocket at some future time.

Film Loops

Excessively large loops not only result in noisy operation and in some instances sidewise unsteadiness, but may also allow the emulsion side of the film to rub against metal surfaces. The sound synchronization is also affected by an oversize intermittent loop. The loop should be only large enough to prevent the possibility of binding.

Take-Up Tension

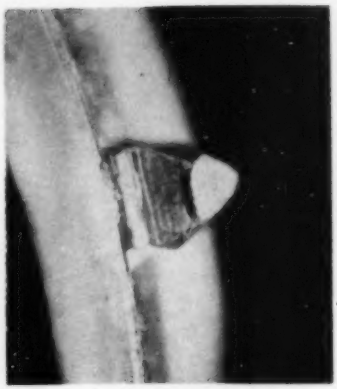
The take-up adjustment should be checked from time to time to avoid unnecessary damage to the hold-back edges of the perforations. Excessive pulling at the hold-back sprocket can be detected by a pronounced "singing" sound and might be caused either by oil on the friction disc or by improper spring adjustment, particularly on older type equipment. If the tension is made too great in an effort to avoid the possibility of loose winding at the end of a large roll, serious damage to the hold-back edges of the perforations in the first part of the roll may occur.

The hold-back sprocket should be checked occasionally for any signs of premature wear. If such wear is found, the take-up tension should be examined and re-adjusted to minimum setting for correct winding.

Automatic Rewinds

Automatic rewinds should be checked for proper alignment. If the flanged and tracked control roller is cocked slightly either vertically or horizontally, undue strain will result on one edge of the film, particularly if the tension is excessive and if there is binding against a bad reel flange.

Hand winding, however, seldom gives the smoothly wound roll obtained by motor winding unless the film is correctly guided to the reel. Film edges which protrude from the reel after poor winding usually break off in small or large sections when the roll is forced into the case, or later, during shipment.



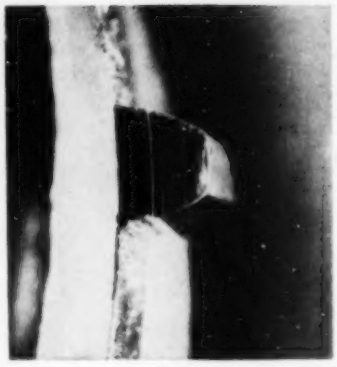


FIG. 5. Other film-ruining profiles ground into sprockets that were kept in service far too long.

[TO BE CONTINUED]

Annual Kodak Wage Dividend

Wage-dividend day (March 7) at Eastman Kodak saw checks totaling about $20,000,000, the largest total sum in the 40-year history of the plan, go to about 49,000 Kodak men and women in the United States. Eligible persons received $27.50 for each $1,000 earned at Kodak during the five years 1947-1951. The payment brought the total U. S. distribution since the plan was begun to approximately $144,500,000.

Kodak started and has continued the plan in recognition of the part its men and women play in the success of the company. The wage dividend must be voted by the board of directors and is based on the cash dividends declared on the common stock during the year. It does not affect wage rates.

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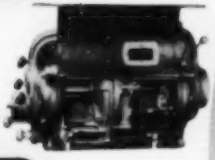
UTILITY



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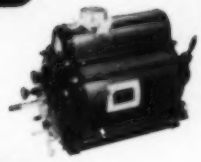

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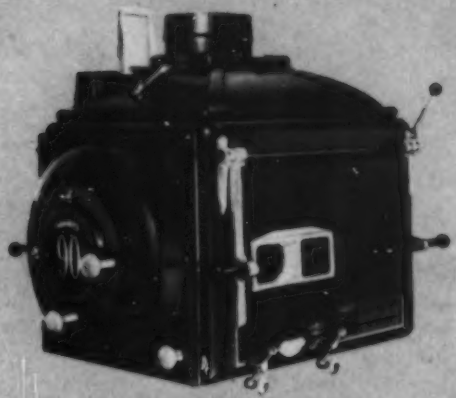

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It is in reducing problems of this character that the Eastman Technical Service is of great service. Their representatives collaborate with studio technicians; they scrutinize the scenery, establish light and color balances; they help select type of film, color or black-and-white, best to use. Special laboratory procedures, too, may be worked out to ensure precise processing—all to make sure that every foot of film produces best results.

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6706 Santa Monica Blvd., Hollywood 38, California

Arclamp Generators

By ROBERT A. MITCHELL

I. Genesis and Theory of the Dynamo*

WITH the single exception of 96-cycle A. C. generated for Cyclex arclamp units (a system not too widely used) all projection arcs are operated on D. C. The advantages of D. C. over A. C. in this application are obvious. The periodic reversal of A. C. current-flow causes the energy of the current to be divided equally between the two carbons, forming two craters, only one of which furnishes light for projection. Moreover, the flicker, unsteadiness and the noise of an arc operated on 50- or 60-cycle A. C. are undesirable.

Appropriate devices for converting the A. C. of the power mains into D. C. of proper voltages for the operation of projection arcs are therefore a necessity for modern motion picture projection. There are three types of current-conversion devices: rectifiers, motor-generators, and rotary converters.

Rotary converters are machines incorporating synchronous motors rotating in exact step with the A. C. fluctuations. By means of commutators, the line A. C. is periodically reversed so as to furnish D. C. Although rotary converters are widely used as power supplies for trolley and subway lines, they have not found favor in theater work. The relative merits of rectifiers and generators have provoked much discussion—each has its ardent supporters.

Performance Characteristics

In general, motor-generators are more rugged and dependable than most types of rectifiers. Rectifiers, however, are lighter in weight and more easily installed. But generators deliver current which is practically independent of line-voltage variations; while the D. C. from rectifiers is merely A. C. "straightened out," leaving the arc subject to line-voltage variations.

The filter circuits of many rectifiers unfortunately fail to remove all A. C. ripple. Specially designed 6-phase rectifiers reduce the ripple to a minimum, yet flickering of the screen light appears where the frequency of the line A. C. is upped from the international standard of 50 C. P. S. to 60 C. P. S. This trouble, which would not be experienced with motor-generators, is due to the interaction of ripple in the rectified current with the 48-cycle light pulsation produced by the revolving projector shutter.

Current Ripple Content

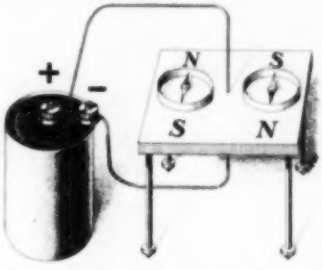
Whenever D. C. having a 50-cycle ripple powers the arc, only two light-beats of small amplitude occur each second. The frequency is so low that the faint beats are invisible. But when a 60-cycle ripple is present in the arc current, the number of beats per second is 12. Even though the amplitude of the beats is no greater, the frequency is high enough to cause noticeable flicker in the picture.

Generator and rectifier units are about equally efficient; but generators are better able to handle temporary overloads, as for example, when an arc is struck. Although the first cost of a good motor-generator is higher than that of a rectifier, maintenance costs are trifling, scarcely more than a dollar or two per year. Rectifiers of the tube type require rather frequent tube replacements, but stack (dry-disc) rectifiers, if guarded against burn-outs, last almost indefinitely. Rectifiers are comparatively silent in operation.

Generator Production of D. C.

How does a generator produce D. C.? The answer lies in the principle of *electromagnetic induction*. This principle is the heart of A. C. generators (alternators) as well as of D. C. generators (dynamos). Alternators and dynamos are very much alike—the chief difference being the manner of collecting the induced current. Also, in large alternators, the current is induced in stationary coils by revolving field magnets.

FIG. 1. LABORATORY DEMONSTRATION OF OERSTED'S FAMOUS EXPERIMENT



A wire conducting an electric current is surrounded by a magnetic field which can be detected with a compass. A compass needle always assumes a position at right angles to a line drawn from the nearest part of the wire to the needle pivot. Note that the North and South positions assumed by the compasses on opposite sides of the wire are reversed. If the connections to the battery terminals be changed, both compass needles will reverse their positions.

In the dynamo (of greater interest to projectionists) this construction is impossible. Because the currents induced in both alternator and dynamo are alternating, it is absolutely necessary in the dynamo to make use of automatic reversing-switch and current-collecting component called a *commutator*. Therefore, the dynamo's field magnets are stationary, and the "inductors" are *armature* coils which revolve in the magnetic field.

Of course, no one knows just what a magnetic field is. We do not know what a space-continuum is, or how it "warps" under certain conditions to produce the phenomenon of a "field." At any rate, magnetism exists: we can produce it in various ways, measure its polarity and intensity, and do all kinds of practical things with it. But a knowledge of its intrinsic nature lies beyond the sphere of physical science, and, possibly, outside the scope of human intellection. Electromagnetism, like our universe of space and time and energy, is one of the transcendental mysteries.

Electromagnetic Induction

The principle of electromagnetic induction, however, is simple because here we are dealing with phenomena and not with the ultimate realities behind appearances. Briefly, this principle is nothing more than the fact that a conductor, such as a coil of wire, has *induced* in it an electric pressure, or potential, whenever it is "cut" by "lines" of magnetic force. In other words, a potential, which can be measured in volts, is created by placing a conductor in a magnetic field which is either increasing or decreasing in strength. This potential is evidenced as a flow of electric current by establishing a closed circuit which allows the current to flow in one end of the "inductor" and out the other. When the density of the magnetic field is increasing, the current flows in one direction; when decreasing, in the other direction.

All this is elementary electrical knowledge; but there was a day when the world's leading scientists knitted their distinguished brows over the problem of inducing electric currents by means of magnets.

The story of events leading up to the invention of the dynamo began about 150 years ago when Allesandro Volta, an

* First of a series of three articles on the development, application and maintenance of generators.

Italian scientist, devised the "voltaic pile," the granddaddy of the modern dry-cell. Before Volta's great discovery, scientists and "natural philosophers" like Benjamin Franklin had to restrict their electrical experiments to "static electricity" obtained by vigorously rubbing pieces of glass or sealing wax with cloth or fur, and storing up the charges thus produced in crude high-tension condensers called "Leyden jars."

The electric charges in the condensers were said to be "static" because they were electricity in a motionless state. The potential which existed between the inside and outer walls of the Leyden jars was high enough to be discharged as crackling sparks resembling miniature lightning flashes. But although the voltage was high—several thousands—the current (amperes) was infinitesimal.

After discharging his jars, the early experimenter was without electricity until he had built up another charge by more rubbing of his "electrophorus," a cake of sealing wax whose electrical properties are said to have been discovered by Otto von Guericke, born in 1602. (In improved forms the electrophorus is the "Wimshurst electrical machine" of high-school laboratories and the Van de Graaff electrostatic generator used in atom-smashing experiments).

Static electricity was of no use whatever for the lighting of lamps or the running of machinery. Electricity was only a plaything and a subject of growing curiosity. It hadn't the ghost of a chance of being of practical use in the world's work until Volta's electric pile furnished scientists with heavy, continuous currents at comfortably low pressures. Nevertheless, a really big voltaic pile—one, say, of 2000 plates—cost considerably more than the average natural philosopher of the day could afford.

The Famous Oersted Experiments

Hans Christian Oersted of the University of Copenhagen was among the first to experiment extensively with the new "galvanic currents." And he made a momentous discovery. He found that the needle of a compass was affected by current flowing through a wire placed near the compass. The needle swung in one direction when placed over the wire, and in the opposite direction when under the wire. Reversing the connections to the battery reversed these two deviations of the needle. (Fig. 1).

Oersted's experiment is child's play today; but in 1820 it created quite a stir in scientific circles. It proved that the forces of electricity and magnetism were somehow interrelated.

In the same year, Britain's leading scientific light, Sir Humphrey Davy, found that bars of iron and steel could be strongly magnetized by winding coils of wire around them and passing current through the coils. Previously, magnets such as compass needles were made by stroking steel rods with pieces of *laedstaen*, or lodestone ("leading stone"), a naturally-occurring magnetic oxide of iron known to mineralogists as "magnetite."

The First Carbon Arc Light

Davy also made another discovery of interest to projectionists. He found that two rods of carbon connected to the terminals of a powerful voltage pile produced an intense white light if touched together and immediately separated by a short distance. A bow, or arc, of luminous vapor conducted the current over the gap between the ends of the rods—thus the arc-light, the indispensable projection illuminant, first shed its radiance on earth.

Sir Humphrey took as his assistant at the Royal Institution of London a bookbinder's helper by the name of Michael Faraday. In those days a scientist learned his trade by working at it. There was no need for a would-be scientist to while away the productive years of youth in academic preparation for admission to a closed corporation of belettered savants.

Faraday quickly showed himself to be Davy's equal, and this initiated a professional jealousy on Davy's part which was to last until his death. No "star," movie or scientific, loves a rival who threatens his eminence. Faraday did his best not to aggravate the situation, even though the outstanding quality of his work forced proud Sir Humphrey to swallow his pride more than once. We must not forget that Faraday got his big chance through Davy, and that Davy permitted his charge to perform experiments in the Royal Institution's laboratory despite noticeable pressure to keep young Michael in his place.

Electromagnetism in Reverse

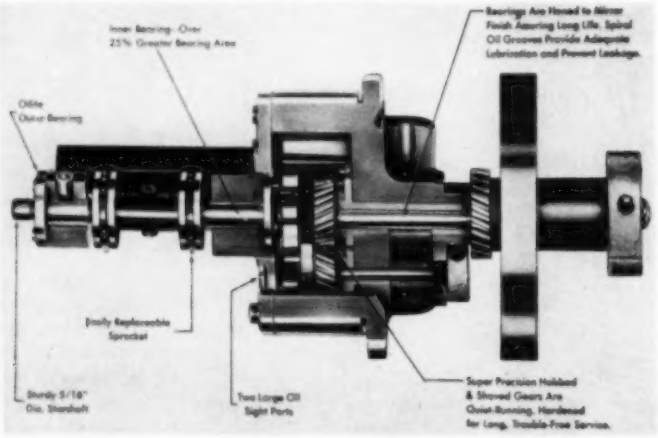
Faraday learned all he could about electricity from books and scientific reports. The problem of electricity and its relationship to magnetism fascinated him and stimulated his fertile imagination. Day and night he pondered Oersted's experiment with the compass needle and Sir Humphrey's electromagnets.

"If electricity can be converted into magnetism," he thought, "surely there must be a way to reverse the process!" He flipped the leaves of his notebook to a blank page and scrawled: "Try to convert magnetism into electricity." That was in 1822; and the electric generator was already aborning in Faraday's mind.

Countless experiments failed, but Michael Faraday beat no disheartened re-

(*Continued on page 28*)

LaVezzi's Newly-Designed Intermittent Movement


Inner Bearing, Over 25% Greater Bearing Area
Bearings Are Honed to Mirror Finish Assuring Long Life. Spiral Oil Grooves Provide Adequate Lubrication and Prevent Leakage.
Oilite Outer Bearing
Easily Replaceable Sprocket
Sturdy 5/16" Dia. Starshaft
Two Large Oil Sight Ports
Super Precision Hobbed & Shaved Gears Are Quiet-Running, Hardened for Long, Trouble-Free Service.

A newly designed intermittent movement has recently been introduced by LaVezzi Machine Works, of Chicago. This unit features a sturdy 5/16-inch diameter star shaft made of tool steel. All moving parts including Cam, Starwheel, Sprocket, and Flywheel Shaft and Gear are hardened for maximum life. Outer bearing is made of Oilite—the material that holds oil like a sponge and assures against bindup. The inner bearing has over 25% greater bearing area. As taper pins have been eliminated in this model, a screw driver is the only tool required to replace a worn sprocket. An illustrated brochure covering this unit is available on request to LaVezzi at 4635 West Lake St., Chicago 44, Ill.

RCA Tv Shows in Berlin Mark U. S. Know-How, Ingenuity

WITH nearly a month of Tv broadcasts in Berlin, Germany, behind them, RCA Service Co. engineers are confident they can meet any challenge the future may hold. The job of setting up a complete television transmitter, two Tv studios, two microwave relays, two RCA PT-100 large-screen theater Tv systems, and more than 100 receivers is a tough one—even when given a reasonable period of time to cope with the many problems involved. Completing the job in 85 hours, and in a foreign country, was a record-breaking achievement.

But that's what was done by a crew of 23 RCA technicians preparatory to showing Tv to more than 1¼ million people in West Berlin. The programs were given with the collaboration of the U.S. High Commissioner of Germany.

Rigid Requirements Met

Especially challenging was the requirement for setting up the two theater Tv systems in out-of-door locations, where protection from inclement weather and the effects of stray light from outside sources were factors to be dealt with. Although the RCA engineers have had several years of experience in the installation and servicing of theater Tv systems in the U. S., the Berlin job presented an entirely new kind of test.

Even before encountering the language, technical, communications, and transportation problems awaiting them, the engineers faced hurdles that resulted in an unforeseen 18-day delay in getting official clearance into Berlin. When they reached Berlin, they found all available truck and automobile transportation tied up in a motor pool due to an alert which lasted for seven days.

Thirty-five tons of equipment was needed to put on the demonstration. The gear was packed and shipped from company headquarters in Camden, N. J., to Rotterdam—a rough, 8-day ocean voyage. Then, by truck and troop train, with numerous loadings and unloadings, it was hauled to Berlin.

Although the receivers came through the ordeal practically undamaged, their installation was a serious problem. The two PT-100 theater Tv systems were installed in the open in Schoeneberg Stadt Park, where RCA had one of its two specially built studios, and on Potsdamer Strasse, within a stone's throw of the Soviet sector boundary. These systems were the same as those that RCA has installed in U. S. theaters.

Structural, Electrical Problems

The home-type sets were placed at strategic locations through West Berlin. Many of the location buildings had been extensively damaged by bombing during the war. Only the first couple of floors had been reconditioned, in most cases. Often, installation men had to scale shaky, jagged columns of masonry to reach suitable elevations for mounting the antennas. When conventional communications facilities proved inadequate for maintaining contact with installation groups in different parts of the city, walkie-talkies were pressed into service. Another problem was the difference in power line characteristics between U. S. and German systems. In Berlin, the power system delivers 200 volts at 50 cycles.

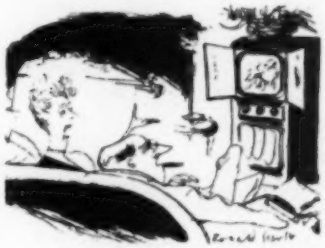
Later, interference problems arose. When the transmitter was erected and ready for testing, it was discovered that the six-megacycle wave-band would knock out one American overseas broadcast, interfere with one of the three channels of RIAS (Radio in the American Sector), and jam reception of French military police cars in their zone. RCA's audio channel also interfered somewhat with reception of calls to police cars in the West Berlin area. Finally, after many conferences, permission to turn on the transmitter was granted. Police radio frequencies were used with the understanding that telecasts would stop immediately if an emergency arose. Fortunately none did.

Problems continued to arise after the Tv system was placed in operation. Receivers located in a large Berlin park were covered with canvas to protect them from the elements. But during a cloudburst one night, after the show, they were thoroughly soaked. The next day, RCA technicians dismantled the receivers and baked the transformers and other parts under sun lamps until they were dry. The receivers were working by showtime that night.

Even the Weather Intervenes

The success with which daily large-screen shows were presented effectively demonstrated the capacity of the PT-100 theater Tv system. The bright, clear 15 x 20-foot screen images were hailed by crowds of thousands at single performances, and drew special praise from U. S. officials in Berlin, as well as officials of the Theater Guild who visited Berlin in connection with the presentation of "Oklahoma!"

As the Tv demonstrations progressed, servicing problems naturally became fewer. By the end of September, with their work successfully concluded, the engineers and technicians were able to look back on their trials and tribulations during the Berlin operations as just another interesting and challenging job in their service careers.



This Week, N. Y. Herald Tribune

"I'm disgusted. They keep showing the kind of movies that drove us out of the theater back into the home.

* * *

Tv Network Growth in 1951

Summarizing the Bell System's progress in the provision of nationwide intercity network Tv facilities, A T & T's Long Lines Department pointed out that, "during 1951 Long Lines added about 6,500 miles of Tv channels, bringing the total to over 24,000. Four cities were added to the network during the period, making available 'live' network programs to 14 stations not served in 1950. Investment in facilities used for Tv rose to $85 million.

Highlight of 1951 was the establishment of coast-to-coast service over the new transcontinental microwave radio relay system, linking Salt Lake City, San Francisco, and Los Angeles to the network; thus making nation-wide telecasts possible for the first time.

IN THE
SPOTLIGHT

Harry Sherman passed away on March 3 after a short illness. This department, which he instituted and nourished with his intense feeling for the advancement of the workingman, will be continued—as he would wish it. To those who, by their devotion to craft welfare and advancement, have contributed in boundless measure to the worth of this department, we express our gratitude. Now, as in the past, "In The Spotlight" will aim for the establishment and maintenance of the highest craft standards—a task which may be measured only by the extent of continuing craft support.

CLAIMING that the poor condition of prints received from the exchanges have made it necessary for its members to spend considerable of their own time in repairing torn sprocket holes, poor splices, etc., San Francisco Local 162 has asked exhibitors to provide extra time in the new contracts for film inspection.

We believe that immediate steps should be taken by the film exchanges to remedy a situation that is becoming prevalent throughout the country. We have received many letters from projectionists complaining about the really shameful condition of the prints they receive from the exchanges. Many projectionists, in order to prevent breakdowns in the theatres, very carefully check each print and make the necessary repairs on their own time—a job which rightfully should be done at the film exchanges.

• Our very best wishes go to Martin Goble, member of Vancouver Local 348, on his new venture as partner in the Vernon Drive-In, at Vernon, B. C.

• An aftermath of the hearing held before the NLRB last June in the jurisdictional dispute between the International Alliance and the National Association of Broadcast Engineers and Technicians was the conviction of George Maher, executive secretary of NABET, for third degree assault on Harold Spivak, who represented the IA at the hearing. Sentence was deferred until a later date.

• IA President Richard F. Walsh is the first labor leader to receive a Brotherhood Award from the National Conference of Christians and Jews. The presentation was made at the recent annual dinner held by the Conference's Amusement Section at the Waldorf-Astoria Hotel in New York City. In making the presentation on behalf of the Conference, Miss Fannie Hurst, the well-known novelist, stated that labor unions are now being enrolled in this organization's effort to combat discrimination, pointing out that "Mr. Walsh is a man who is contributing a great deal to the kind of thinking we are doing."

• William Maddocks, president of Local 570, Michigan City, Ind., was recently elected to the presidency of the Michigan City Central Labor Union.

• The National Labor Relations Board at Washington, D. C., in the first action of its kind, revoked a certification of a patent national union as the bargaining representative for a group of employes in a Chicago plant, because the Local active among the employes had not filed non-communist affidavits for all of its officers when the certification was issued. The unions involved are the United Electrical, Radio and Machine Workers of America, unaffiliated, and its Local No. 1150.

• Our congratulations to Arthur Milligan, one of the old-line members of Toronto Local 173 on his election to the office of business representative, succeeding the late Wm. P. Covert.

• H. Goldin, of Toronto, has established a complete acoustical consulting service for architects, engineers, builders and building management. This is believed to be the first full-time acoustical engineering service of its kind in Canada. The service covers the entire field of architectural acoustics, sound reinforcement, noise isolation and associated problems encountered by builders and operators of such structures as theatres, auditoria, broadcasting stations, schools, churches, arenas, music studios and multiple dwellings.

Hy was responsible for the acoustical design of all new Odeon theatres in Canada and the majority of larger theatres built in recent years by other companies. For 17 years he was on the technical staff of Northern Electric Co., where he was responsible for the installation and maintenance of theatre sound equipment. During World War II, Hy was loaned to Victory Aircraft, Ltd., to do engineering and design work in connection with military airborne

(Continued on next page)

IA MEN HONORED ON 25TH ANNIVERSARY OF ROXY THEATRE, NEW YORK CITY

David D. Katz (center), executive director of the Roxy Theatre, is shown presenting gold watches to four IA men who have been with the theatre since it opened on March 11, 1927. Recipients of the awards are (left): Jeff Smith, chief electrician, and Herman Ostersen, electrician, members of N. Y. Local 1; John Janitz and Frank Nealy (right), projectionists, members of N. Y. Local 306.

Projection Room Ventilation *a la* British

IMPROVED ventilation of projection rooms has ever been a prime concern of projectionists' organizations on two counts: the entrance of fresh air from the outside or through the theater ventilating system, and the exhaust of noxious fumes emanating from the carbon arc lamphouse. Data now at hand indicates that the British have contrived a rather ingenious device for exhausting such fumes, and it has the added virtue that it resists backdrafts.

But first a resume of a serious American effort to overcome this problem. Several years ago IA Local 150 of Los Angeles succeeded in having the State Labor Code amended so as to compel the use of modern ventilating means. Subsequently, however, it became evident that one serious omission in this legislation was a means for preventing backdrafts of noxious fumes, particularly when the wind was blowing in a certain direction.

The Local 150 Proposal

The Local 150 proposal for overcoming this defect, as culled from the pages of IP,* is stated briefly here:

It has been found upon investigation that the prevailing wind, if of great enough velocity and blowing in the direction of the exterior arc lamp exhaust stack, forms an impasse for the exhausted gases, creating a backdraft and bringing the fumes back into the projection room.

* "In the Spotlight"; IP for Aug., 1951, p. 20.

The installation of automatic funnels or hoods at the extremities of the exterior arc lamp exhaust stacks will prevent the return of carbon gases to the projection room. These devices are similar to the funnels used on shipboard to ventilate between decks. The funnels are L-shaped and finned so that the prevailing wind may rotate them 360 degrees. They should be mounted on ball bearings to allow for ease in rotation: in this manner the funnel is turned away from the direction of the wind, making it impossible for a backdraft to occur. This is an inexpensive installation and would remedy the situation.

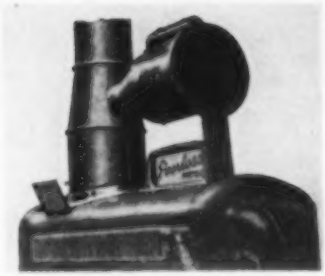
In drive-in theaters, in most instances, the exterior arc lamp exhaust stack, or duct, is too close to the projection room ventilation intake duct, with the result that the lamphouse exhausted gases are being drawn back into the projection room. The exhaust stacks, or ducts, should extend not less than 25 feet away from the projection room intake duct and be equipped with automatic directional exhaust hoods.

The accompanying line drawing details the ventilation setup suggested by Local 150.

Details of Ventarc Unit

The aforementioned British unit, known as the Ventarc, is described by F. E. Durban, Director and General Manager of J. Frank Brockliss (London, England) as follows:

The principle involved is that the ventilating system is manufactured as a unit to be mounted on the top of each projection lamp; the fan unit, of the turbine design, draws the air across the motor unit itself and directs the stream of air into a jet unit under pressure. The jet unit blows the air into the main exhaust chimney at great force so as to cause a vacuum behind, which induces the fumes from the arc in a controlled exhaust movement. Therefore, it is certain that the objectionable fumes which deposit themselves on the lamphouse



Arclamp mounting for Brockliss Arcvent unit.

parts and mirror generally are, by the new system of ventilation, induced by controlled draft to the open air.

Wind Direction, Velocity Immaterial

It follows naturally, also, that prevailing winds at the outside of the theatre do not interfere with this ventilation, due to the force of the jet unit in operation. It necessarily follows, also, that the Arcvent does give controlled ventilation irrespective of weather conditions and high efficiency concerning the burning of the arc, which is undisturbed by any exterior elements.

In addition, the fan unit also (which should be left running all day whether the projection lamp is burning or not), ventilates the projection room and in the case of an accidental fire would disperse the fumes quickly from the projection room, since the fan unit is situated near the film mechanism; also, the unit being left in operation all day cools the working parts of the lamp when not in use. Thus the projection lamp parts are ready for handling without any undue heat due to the extra cooling which is induced by the system.

A Projection Room "Must"

We found that mirrors are kept very much cleaner and do not require the usual wiping. Altogether, this unit invention is being

(*Continued on page 25*)

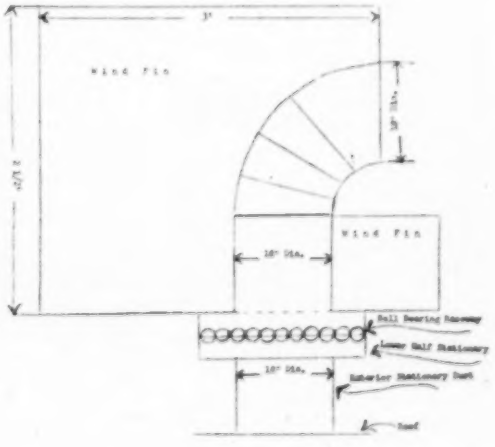
(*Continued from preceding page*)

communication equipment. After the war he organized the technical department of Gaumont-Kalee (J. Arthur Rank organization) as chief engineer.

Hy has now established his own practice. He is a member of the Association of Professional Engineers of Ontario, the Acoustical Society of America, the SMPTE, the IRE, the British Cinematograph Society, and the Physical Society of Great Britain. He has authored papers read to the SMPTE and the IRE, and has also written extensively on sound engineering and reproduction.

• Edwin Graham, Boston Local 182 and a veteran of World War II, was recently appointed chief projectionist at the West Roxbury (Mass.) Veterans Hospital.

• According to an item in the industry trade press, the New York Council of the National Association of Broadcast Unions and Guilds, AF of L, voted unanimously to oust the National Association of Broadcast Engineers and Technicians from membership, accusing NABET of "raiding" and "creating disharmony."



Reproduction of a sketch accompanying the recommendations of Los Angeles projectionist Local 150 for an improved means of exhausting noxious gases from projection rooms. Details of the hookup are given in the accompanying article.

Stereoscopic Motion Pictures

By J. A. NORLING

President, Loucks & Norling Studios, Inc., New York

Supplementing articles of the same title which appeared in IP for Aug., 1951 (p. 12) and for Feb., 1952 (p. 9) (and to be regarded as a third installment thereof) is the appended extension of remarks as they appeared in the *Journal* of the Photographic Society of America (Jan. 1952, p. 19). Widely recognized as an authority on the stereo art, the author's stature is further enhanced by this presentation.

THE *N. Y. Times*, early in 1944, reported that Simyon Ivanov, a Soviet artist, had invented a screen having tiny squares of thousands of strands of fine wire which produced third-dimensional effects without the use of eye-glasses.[1] James Aldridge, writing on the same subject for the North American Newspaper Alliance, reported that the images reproduced through the screen were "coarse and blurred".

The article goes on to say that the original Ivanov grid system had been improved and developed in the Sgvintorgkino Studio to the point where it promised to become practicable. To quote from the article:

"The glass screen is engraved with more than 2,000 converging lines, and it is in these markings that the secret of the new screen lies. In photographing third-dimensional movies, the only alteration required on standard cameras is the addition of two or more mirrors fitted near the lenses to reflect the images onto the film."

Obviously, this appears to describe Ivanov's photographic process as being an application of the beam-splitter principle.

The article goes on to say:

"In showing the film, it is projected onto 'two or more mirrors,' instead of directly onto the screen, which reflects the shadows onto the glass screen. In turn, the lines on the screen unscramble the images, resulting in a clearer image than has hitherto been obtained in third-dimensional film experience."

Then, in October 1945, the *Wall Street Journal* reported further on the Ivanov development:

Moscow (AP)—The Soviet film industry is preparing a surprise for the world's movie fans—a special production of "Robinson Crusoe" to be exhibited on a new stereoscopic screen designed to give rounded, three-dimensional images.

Simyon Pavlovich Ivanov, the inventor, said that the screen creates an illusion so perfect that people unconsciously dodge when pictures of birds or airplanes are shown.

Ivanov said he believed the screen surpasses anything Hollywood had done to achieve realism in the exhibition of motion pictures.

On April 29, 1948, the *New York Herald-Tribune* published the following:

Moscow, April 28 (AP)—The Communist newspaper *Pravda* disclosed today that Simyon P. Ivanov, described as the inventor of three-dimensional motion pictures, had been removed from the job of scientific chief of the special studio in which he perfected the invention.

The newspaper (*Pravda*) said that I. Bolshakov, Motion Picture Minister, did not take Mr. Ivanov's work seriously, tried to picture him as a faker and publicity seeker, and finally pulled him off with the excuse that he was freeing him from his administrative duties.

Pravda went on to state:

That's how the cinema industry freed itself of the worrisome individual whose name will go down in the history of the Soviet and world cinema.

Truly, workers on the grid method of stereoscopy have a bad time when someone eventually discovers that the image don't appear satisfactory throughout an auditorium.

Parallax Stereograms

Parallax stereograms are of two principal kinds, one using a grating, or "grid," as the selecting screen placed in front of the images, and the other using a selective screen consisting of small cylindrical lens elements, lenticules, side by side and running vertically.

The "grid" system was introduced by Berthier in 1896 and was the first form of stereoscopic viewing of still pictures that did not require accessories. The grid consisted of vertical bars with spaces in between. The grid was usually made on a high-contrast photographic plate. The picture was a composite which had the two images broken up into bands, the image bands for one eye being interlaced between the image bands for the other. When the grid was spaced at the prescribed distance in front of the composite and viewed from the correct distance, the observer was able to see a binocular view.

The "lenticular" system used a selective screen sometimes registered in front of the images, sometimes directly bonded to the composite photograph. The lenticules do not cut down the reflected light as do the bars in the grid system. In one system, the composite picture is made in a single-lens camera which swings through an arc during exposure. The center of the arc is in the plane of the subject.

Lenticular systems are credited to several inventors, among them F. E. Ives and his son, Dr. H. E. Ives. Dr. Ives called his the "Parallax Panoramagram." Improvements have been been made and further developments carried out by the Americans, Vanbenschoeten and Winnek, and the Frenchman Bonnet.

The Zafiropulo Process

Another invention employing the lenticular principle is that of Jean Zafiropulo, who set out to apply it to the motion picture in particular. The process requires extremely accurate alignment of all elements in photography and projection.

The Zafiropulo process involves the use of a film containing embossed spherical lens elements in its base. Prints must have their lens elements exactly aligned with those in the negative. The lens elements must register with the greatest exactitude in relation to the sprocket holes in the film. Sprocket teeth, engaging the sprocket holes, serve as the basic registration points for picture steadiness.

Film shrinkage, which is over ¼% in the lowest-shrink film base, will have to be overcome to prevent lens-element misalignment with relation to the sprocket teeth, and in turn to prevent misalignment of the film lens-elements and the screen lens-elements.

The Zafiropulo process requires only one lens in photography, but it must be of large diameter, from 2½ to 3 inches, and such a lens must be of long focus, over 6 inches in an F:2.5 lens. This is about 153 mm compared with the 40- and 50-mm lenses most frequently used

in film studios. This long focus lens requires more studio space than is needed in conventional filming.

Several other methods have been proposed for the lenticulated (goffered) film process of movie stereoscopy. (Fig. 9). One is, in essence, an application of the "beam-splitter" principle, differing from it in that it produces a series of bands for each image. One band, for part of the left-eye image, is formed through each lenticule, and another band is formed adjacent to it for the corresponding part of the right-eye image, through the same lenticule. The lens must be operated at its widest aperture.

Lippman's "Integral" System

The process of "integral" photography discovered by Lippman in 1908 utilized a screen composed of an almost infinite number of small "lens elements" in the form of pin-holes. It affords what most who have seen it consider the ultimate in stereoscopic viewing. It differs from any other system of stereoscopy in that it provides a much larger number of images in the plane of the photograph and "reduces the number of viewing instruments to zero."

But Lippman's integral photographs can be made only as transparencies, and they cannot be projected, nor can they be reproduced to supply copies that have the qualities existing in the original.

These integrated stereograms are made through a screen having a great number of pin-holes, each acting as a camera lens. No camera is used: the pin-holes serve as lenses. The screen can be a photographic image in a contrasty emulsion on the front side of a glass plate, with the photographic image produced through it on an emulsion on the back. The holes must be quite small, their size being established by the rules applying to pin-hole photography. There must be a great number of holes for every square inch, and the plates should be quite large, 8 x 10 inches or more.

Exposure is made through the pin-holes, and since the effective aperture of each pin-hole is extremely small, long time exposures are essential. They cannot be satisfactorily reproduced, hence copies are not obtainable, and the negative image has to be rendered into a positive by reversal. Viewing should be with a mirror placed so that the proper left-right attitudes of the images show.

The nature of the process excludes it from practical usefulness, particularly for motion pictures, but it is an interesting thing with which to play, and can be experimented upon by anyone having the required facilities.

A Single-Lens Camera for Motion Picture Stereoscopy

If two-strip stero films are used, such things as titles can be made by exposing one image, for the required footage, then shifting the camera to expose the other, as is done in making "slide-board" stills.

A variation of the principle can be applied to obtain stereoscopic motion pictures, especially aerial shots. The writer has made such films using only *one* camera, and making only *one* negative. Two prints were made from these single negatives and projected in interlock on two machines. However, the prints were projected with one print having its frames displaced in relation to the other's.

The number of frames displaced is governed by the plane's elevation above the ground and above the nearest object, in scenes looking straight down. Frame displacement is also governed by the ground speed of the plane. A plane flying at 100 miles per hour will cover 144 feet a second, which means that 6 feet is covered in every second for a film speed of 24 frames a second. A full reel was made during flights over New York City, the camera pointing straight down. The plane was flown at 2500 feet, and slow-motion photography of 96 frames.

A film speed of 96 frames a second with a plane speed of 100 miles per hour gives 1½ feet of advance along the course as registered by every frame. Using the equation $\frac{D \times d}{D - d} + 50$, established the base of the interaxial that would result in the most startling visual effect with the least eyestrain. The farthest plane, D, the ground; the nearest plane, d, the top of the Empire State Building; and the divisor, 50, indicated an interaxial base of 40 feet and this was achieved synthetically by a displacement of one film with the other of 30 frames. Actually, a displacement of 15 frames was finally selected to give the best results.

Some stereo shots were made up in this way from stock footage taken from a plane flying over the Andes. The plane was flying about 180 miles an hour and the exposures were made at normal camera speed.

The most startling of these shots was one that included "The Christ of the Andes." This heroic statue was in the middle distance and stood out in vivid relief against the mountains beyond.

There is one thing that creates quite a problem: any unsteadiness in the airplane's flight. This comes out in the projection as a constantly changing vertical and horizontal, and sometimes rotational, displacement between the images. Such displacements existed in the films we made and had to be eliminated by optical duping methods involving a complexity of steps.

"Vectograph" is the name applied to a clear plastic sheet on which an image may be rendered in terms of varying degrees of polarization, and viewed

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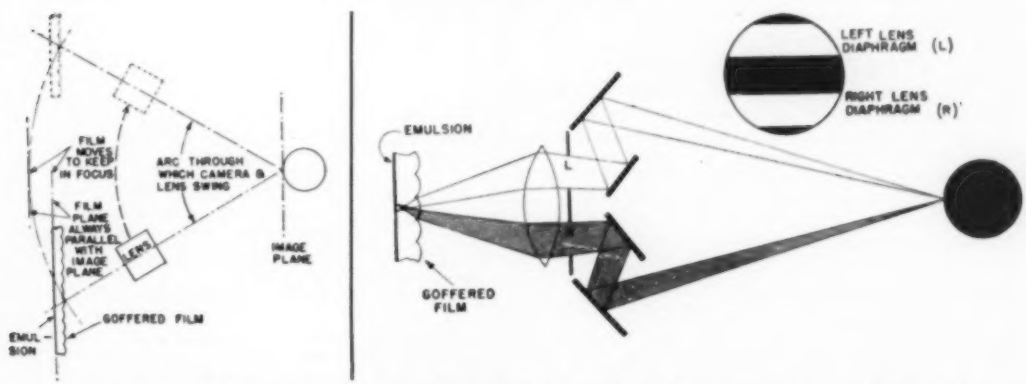

FIG. 9 (left): One type of camera for making lenticular stereograms. Right: A method of lenticular stereoscopy employing the beam-splitter principle with the addition of slit diaphragms. A detailed explanation of the system is given in the article.

LETTERS TO THE EDITOR

To the Editor of IP:

I refer to Mr. Robert A. Mitchell's article in your January issue* where he strictly advises against the oiling of friction takeup discs on lower magazines, and I quote: "Lubrication in this part of the projector will only make the takeup action uneven, tear the sprocket holes of film when the projector starts (due to lag in the turning of the lower reel), and cause the film to wind up irregularly."

I have no doubt about Mr. Mitchell getting good results from his dry discs, but in my 24 years experience with projectors I have made it a practice to keep the leather friction discs well oiled and my results have been highly satisfactory. I have no trouble with the reel jerking and tearing sprocket holes when the projector starts. My tension is even and has just the proper drag to take up a full reel of film.

My present projectors are Century and have been running for ten years. I have examined the leather friction discs this day and they are in perfect condition—the oil has had no deteriorating action on the leather, the surfaces are smooth and show no signs of wear. I feel that oil is necessary to prevent wear of the discs.

I would be glad to hear the opinion of the manufacturers as "To oil or not to oil."

J. G. Jackson.
Capitol Theatre, Port Alberni, B. C., Canada.

* "Projectionist's Role as a Showman," (III) by Robert A. Mitchell; IP for Jan., 1952, p. 5.

Mr. Mitchell Compares Notes

Mr. Jackson's interesting comment on the oiling—or non-oiling—of takeup friction discs serves to focus attention on an important trouble-spot in motion picture projection. If the takeup fails in its function, film piles up in the soundhead. The show stops dead, and projector gears may be stripped. Before acetate films came into wide use, disastrous film fires have resulted from this cause.

On the other hand, excessive tension applied in the hope that it will provide positive insurance against takeup failure may injure film perforations, especially throughout the first 100 or 200 feet of film.

Whether "to oil or not to oil" depends on many things. The make and model of projector, for example. The old Powers required grease on one side only of the fiber disc. Motiograph projectors employ cork discs in the takeup. These must be lubricated with oil, both sides. When felt discs are used instead of leather in the Simplex-type of friction arrangement, best results are obtained when the felt discs are lubricated with a grease such as vaseline.

Projector Age Important

But a clear distinction should be made between a brand-new projector and one that has been in use several years. The possibility of oil dripping from the mechanism onto the friction clutch must also be taken into consideration by the projectionist, if not by the projector manufacturer.

Let's assume that a new leather friction disc is put into a machine having the usual Simplex type of takeup. In the first place, the leather should be dressed with Neat's-foot oil, if it has not already been prepared for use. Then one side of the leather should be roughened a bit with sandpaper and kept free from oil. The other side should be *lightly* oiled with the regular projector oil. In fact, I gave this "prescription" in two previous articles. (IP for August 1948, p. 30, and IP for April 1949, p. 10.)

This prescription is about the best that can be given *provided* that there is no over-oiling of the mechanism or soundhead, and that there are no ways for oil to leak or drip on the friction-clutch assembly. Unfortunately, this is not the case in most of our theatres, so I felt that it might be better to prescribe something a bit different in the case of *old*, "broken-in" projectors found in so many theatres.

Oil-Removal Procedure

Mr. Jackson is mistaken if he thinks that the carbon-tet washing of the oil-soaked leather discs removes *all* of the oil. It doesn't. It removes *most* of the oil, but leaves just enough to provide adequate lubrication. The discs are therefore not perfectly dry, even though they feel dry, after treatment, to the fingers. Rub a treated disc across a clean piece of paper, and an oil streak will show up. In fact, it would require many

STEREOSCOPIC MOTION PICTURES

(*Continued from preceding page*)

through a polarizing filter. The vectograph can accommodate an image on both its sides, and each image can be made to have its axis of polarization at right angles to that of the other. A stereo vectograph has the images of a stereo pair printed respectively on top and bottom of a vectograph sheet, and is viewed through polarizing spectacles with its respective windows having polarizing axes corresponding to those of the vectograph images.

In slide form, the three-dimensional vectograph can be shown in a standard monocular projector without filters. As in other systems using polarized light, silver non-depolarizing screens and polarizing viewing spectacles are required.

During World War II the three-dimensional vectograph was used by the armed services for aerial reconnaissance and for training personnel in various skills. Other uses for this novel, paper-thin stereo picture will doubtless be found. Its picture quality is excellent and its ease of handling and processing are distinct advantages for any photographic process.

Three-Dimensional Pictures and Tv

Inevitably today, any new method of visual presentation, both still and motion, can be telecast. As a matter of fact, an experimental stereo-Tv system has been at work in the Argonne National Laboratories. It permits an operator to keep a precise watch over the "hot" materials he is handling by remote control. Equipped with a pair of viewing spectacles and with eyes glued to a pair of Tv screen images which are transmitted by a binocular Tv camera, the operator does get a three-dimensional impression.

But the problems involved in presenting satisfactory three-dimensional Tv to the public may be so very great that, by comparison, the problems of introducing color Tv have been small indeed. It is anybody's guess when stereo Tv will enjoy a widespread audience; if the history of stereo movies can provide a clue, the time is many years away.

Non-Stereo System

A sytsem which has recently been described as producing a three-dimensional effect is the Cinerama development of Fred Waller.[2] This method, requiring a multiplicity of cameras and projectors, presents a dramatic panoramic view of the scene photographed. But it is not three-dimensional at all, since it does not present a mutually exclusive image to each eye, the basic requirement of any three-dimensional system.

1 The Ivanov system of stereoscopy was discussed in IP for April, 1941 (p. 12); December, 1947 (p. 17); April, 1948 (p. 29), and August, 1949 (p. 13).

2 "Cinerama: Super-Movies of the Future"; IP for November, 1950 (p. 10).

hours of soaking in ethyl ether, with several changes of fluid, to remove all of the oil. And I certainly do not recommend ether. It is unnecessary and much too dangerous.

Perhaps I wasn't explicit enough; but, at any rate, Mr. Jackson and I seem to disagree on the relative merits of very oily and comparatively dry leather friction discs. As Mr. Jackson may suspect, my observations were based on personal experience in a number of theatres.

In some theatres I have found the projectionists actually leaving the lower magazine doors open at changeovers and giving the takeup reel a spin with the fingers at the moment the projector motor is switched on. Just to be sure that the reel turns! And in other cases the theatre manager would tell me that the projectionist had been experiencing trouble with his takeups. In one instance I found the projection-room floor covered with film, and in another, the "assistant" was winding up the film at the rewind bench just as it issued from the projector—the takeup just wouldn't take up.

Takeup Tension Springs

In most cases of this nature I have found excessively oily (as well as dirty) friction clutches to be at fault. What would you do, Mr. Jackson, if you were called to a theatre to remedy this trouble, and found the takeup tension springs just as tight as anyone can get them, and the belts satisfactory? Leave the goop on the friction clutches and tell the harried projectionist to work out his own solution?

A special case was discussed in my January article, i.e. the case of lost loops on certain types of soundhead. The trouble was tracked down and corrected by me just as I described it; and I passed along this information via IP in the hope that other projectionists bothered in this way might avoid the prolonged process of tracking down the trouble.

I have no comment to make on Mr. Jackson's apparently satisfactory experience with oiled friction discs. It may be that he keeps his tension springs tight, or that he avoids that excess of oil that might reasonably be supposed to cause serious trouble. It would seem that he and I, using different methods, have attained the same end—perfectly satisfactory operation.

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BOOK REVIEWS

BASIC ELECTRONIC TUBES, *by Donovan G. Geppert, 332 pages, 6 x 9, 273 illustrations and diagrams, with preface, contents, alphabetical index, and extensive bibliography. One in the Electrical & Electronic Engineering Series by* McGraw-Hill Book Co., New York City, *36. Price:* $5.00.

Each of the 11 chapters in this book covers a different type of electronic tube in a logical and practical manner, excluding the circuit applications in order to discuss each tube more fully. For each type of tube the reader is given, first, the physical appearance and characteristics . . . then an experimental circuit diagram, together with a discussion of the tube's electrical characteristics; the physical theory of the tube, with many helpful analogies; and, finally, the mathematics surrounding the tube's operation.

Each of the tubes is discussed *in a separate chapter*, with each chapter divided into *four distinct sections*.

The book treats the basic kinds of electron tubes from a fundamentally practical viewpoint, without sacrificing essential theory and mathematics. It does not deal with circuit applications, devoting this space instead to a more complete discussion of electron tubes. The book's logical, systematic development enables one to look up a point about a tube's physical or electrical characteristics without considering theory or mathematics unless one wants to. The book progresses from the simpler to the more complex types of electron tubes, explaining such aspects as atomic theory and electron ballistics as integral parts of the theory connected with each tube.

Even though such special tubes, as photomultipliers and multi-grid mixer tubes are not taken up, the principles governing their operation are discussed in connection with the more basic electron tubes.

Tubes discussed are the high-vacuum and gas phototubes; high-vacuum thermionic diodes; high-vacuum triodes; tetrodes and pentodes; beam-power tetrodes; cathode-ray; glow-discharge; thermionic gas diodes; thyratrons; mercury-pool arc rectifiers, and ignitrons.

• • •

SOUND FILM PROJECTION, *by Messrs. F. W. Campbell, T. A. Law, L. F. Morris, and A. T. Sinclair. A symposium in print by representatives of four leading equipment manufacturers in Great Britain. 332 pages, 228 illustrations, alphabetically indexed. Published by* George Newnes, Ltd., *Tower House, Southampton St. Strand, W. C. 2, London, England. Price: 30 shillings British.*

Four acknowledged experts in various callings of the recording, reproducing and acoustical corridors of the mechanical and electronic arts have joined forces to produce a symposium in print of the latest developments a la Britain in the soundfilm projection field. The work deals with five equipments well known in the British Isles: RCA, Ltd.; Gaumont-Kalee, British Acoustic, British Thomson-Houston, and the Western Electric, Ltd.

However basic may be the information conveyed by this volume (with perhaps scant appeal to the American technician but probably of interest to our brother craftsmen in Canada and elsewhere throughout the world), it must be said, again, that these British have a knack for the marshalling and exposition of technical data which is seldom equalled and almost never exceeded by any other group of technical writers. The book is clear and concise, to the point, and actually informative by reason of its avoidance of all technical-language cliches which all too often obscure rather than reveal.

Especially valuable is the section dealing with sound-reinforcement and public address systems, a section of the sound-reproducing arts which is all too often neglected in such works. Also of particular interest is the section on "Theatre Television" which offers a clear presentation of the present state of development of this rapidly expanding art.

Theatre projection, they say, is the same the world around, and acceptance of this estimate warrants the statement that this book provides a clear exposition of the construction, installation, maintenance and operation of basic and proven designs of all sound reproducing equipment.

Fortunate, indeed, are the theatre operators whose projectors are powered by Hertner Transverters, noted for long, trouble-free life—many of which have been used continually for three decades.

Restrictions imposed by the defense effort may prevent present improvement of your power conversion problem, but now is a time to make the decision to change at the first opportunity to better and more economical equipment that provides *direct current at constant amperes at the proper voltage*—a feature of the Hertner motor-generator Transverters.

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IA ELECTIONS

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LOCAL 163, LOUISVILLE, KY.

C. H. Young, *pres.*; Henry Kirk, *vice-pres.*; E. F. Williams, *fin.-sec. & treas.*; J. D. Hulett, *rec.-sec.*; C. Demaree, *bus. rep.*

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LOCAL 570, MICHIGAN CITY, IND.

William Maddocks, *pres.*; Henry Jensen, *vice-pres.*; E. L. Holem, *sec.-treas.*; Walter Glafcke, *bus. rep.*; E. L. Holem, *del. IA Convention.*

PROJECTION ROOM VENTILATION

(*Continued from page* 19)

received by all projectionists as a very useful asset to their working conditions. We are enclosing a copy of a letter received from a projectionist who is very impressed with the capabilities and performance of this apparatus. We should also mention that we have received a further letter from a second projectionist which points out that the Arcvent unit should be installed in all projection rooms, as the most incurred for installing the units is as nothing when it is considered that human lungs cannot be bought at any price.

Our attention was drawn to this problem by the projectionist of the R.M.S. *Coronia*, who visited your office and indicated he had seen the Arcvent in operation while his ship was docked in Liverpool.

Enclosed in Mr. Durban's communication is the following letter from the manager of a British theater in the provinces:

Works Out Perfectly in Practice

We are in an exceptionally exposed position, standing on a hill with no sheltering building near and from 5-9 miles of open country in any direction. On the southern and westerly sides is a high range of hills with Salisbury Plain on the other side, so the prevailing winds come with a fierce blast and the first object to stop them is our theatre.

So we have had a fierce down-draught in the Arcvents. No mirror has been shattered through this, and it used to be the normal thing to carbon-up with the fumes from the other arc blowing into one's face; on windy days fumes and smoke would pour out of the lamphouses. I am happy to say this is now a thing of the past, and the air in the projection room is clear and dust-free. What did cause some surprise was the definite increase of light towards the end of the performance, due to non-clouding of the mirrors.

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You even get your entire requirements of many expendable items. Included are electron tubes for amplifiers and power supplies (including arc supply rectifiers), all exciter lamps, oil, film cement, lens cleaner and tissues. Arc lamp carbons and incandescent projection lamps are excluded. Booth spares are maintained.

Liberal Overhaul Provisions

Even major overhauls of projector mechanisms, intermittent movements and arc supply MG sets are provided under the RCA COMPREHENSIVE PARTS and REPAIR PLAN. In such cases the Plan covers all costs of factory or repair shop labor in addition to cost of parts. It also provides for loaner units without charge and for all shipping charges both ways.

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The advantages of RCA Service are yours at a cost so low, a few admissions daily pay for it. *Write for complete information.*

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CAMDEN, NEW JERSEY

Puts His Money Behind His Faith in the Future Of the Motion Picture Theatre Industry

Modern Theatre Equipment Company's New Five-Times-Enlarged Sales Floor in Dallas

Henry Sorenson, veteran theatre supply dealer of Dallas, Texas, has signalized his opinion of the future of the motion picture industry by opening a new supply store five times as large as his former premises.

The premiere of the new place of business was celebrated with a Texas-size barbecue that attracted over 600 Lone Star exhibitors from cities as far as 500 miles away. Additionally, Oscar Neu, head of Neumade Products, came down from New York; Fred Matthews of Motiograph came from Chicago; Jack Zern of Altec Service Corporation, A. E. Finke of Coinometer, and representatives of National Carbon and other manufacturers joined in the festivities.

Sorenson's organization, Modern Theatre Equipment Company, repairs projectors and lamps, and sells the products and services of Altec Lansing, Bausch & Lomb, GoldE, Imperial Electric, Kollmorgan, Motiograph, National Carbon, Neumade and other leading companies in the field of theatre furnishings, equipment, supplies and service. An ample supply of loan equipment enables the company to lend any type and make projector or lamp that may be needed to keep the show running while the theatre's own equipment is taken to their shop for repairs. 1916 Jackson Street, Dallas, is the location of the new, enlarged premises.

Barnett to Parent GPE Company

Herbert Barnett has relinquished his post as executive vice president of General Precision Laboratory, Inc., to join the parent organization, General Precision Equipment Corp., as assistant to the president, Herman G. Place. Other important subsidiaries of GPE are National Theatre Supply Co., J. E. McAuley Co. (Peerless lamps); Strong Electric Corp.; International Projector Corp., and Hertner Electric Co. (generators).

Mr. Barnett has been identified with the motion picture and electronic industries for more than 18 years, and he played a prominent role in the development of the GPL intermediate-film and direct-view Tv systems. He is presently executive vice president and chairman of the executive committee of the SMPTE.

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Write for complete information to Bausch & Lomb Optical Co.,
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Bausch & Lomb *Super Cinephor* Projection Lenses

Strong's "Trouper" Spotlamp

A new slide projector attachment, for use with the widely sold Trouper high intensity arc spotlamp, has just been developed by the Strong Electric Corp., Toledo, Ohio. It is especially designed for use in projecting song and advertising slides in theaters.

The intense light of the Trouper projects a clean, sharp, clearly-defined picture, even on the largest screens, with motion picture brilliancy attained on screens up to 22 feet wide. The Trouper plugs into any 110-volt outlet, with no heavy rotating equipment being necessary. An adjustable, self-regulating transformer is an integral part of the base. A trim of carbons burns 80 minutes. The arc is automatically controlled.

SMPTE Convenes April 21-25

Monday, April 21 to Friday, April 25 are the dates for the 71st Semi-Annual Convention of the Society of Motion Picture and Television Engineers, President Peter Mole has announced. The place is Chicago, at the Drake Hotel.

Program Chairman George W. Colburn reveals that sixty papers will be delivered covering motion picture projection, theatre TV, three-dimensional effects, industrial TV, motion picture sound, film processing, new motion picture screens and other topics.

The semi-annual get-together luncheon is scheduled for noon of the 21st and the cocktail hour, banquet and dance for the evening of the 23rd.

THIS EXPLAINS A LOT

". . . in the television industry I have come across occasional cases of negligence in the care of lenses, e. g., wiping dust and grit from the elements with coat sleeves, shirt tails and grimy handkerchiefs."

So reports Marvin Jacobs, Ph.D., of the engineering department of TV station KECA, in the March, 1952 issue of *International Photographer*. Dr. Jacobs goes on to advise TV personnel to "handle the lens by the mount, *never* touch the glass. Handle the lens gently."

Were you wondering how that TV you saw last night could possibly have gotten that way?

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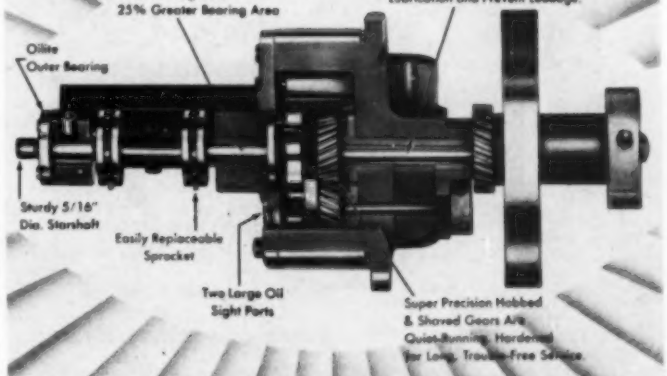
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The 'heart' of your projector—the unit on which so much depends—has now been re-designed by La Vezzi for steadier projection and better box-office—and at no increase in cost. Now is the opportune time to protect your theatre investment. See this 1952 beauty at your dealers—or write direct for illustrated brochure!

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First Copper Salvage Report

First reports by Nate Golden of the NPA on the copper-dripping salvage drive include the following figures: *three* New England theaters turned in more than 200 pounds of copper drippings to the designated Boston supply dealer; San Francisco netted $143.78 for the Variety Club Welfare Fund; Charlotte, N. C., turned in $90.30, and Minneapolis kicked in $39.20.

These initial reports point up one very important fact—the *difference in prices* paid for these copper drippings. In San Francisco the price was 17¾ cents per pound, while in Charlotte it was 15 cents, and in Minneapolis 10 cents. IP has been informed that a fair price for these drippings, which are generally reported to be 94% pure copper, would be about 15 to 16 cents a pound.

The price, of course, would vary according to the quantity of drippings offered for sale and whether the drippings were delivered to the scrap dealer or whether he had to pick them up. It is suggested that several scrap dealers be consulted before disposing of these drippings to be sure of getting the best price.

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ASA Acoustical Terminology

An "American Standard Acoustical Terminology" has just been issued by the American Standards Assoc. It supersedes the 1942 edition and has a much greater scope. Among the new subjects covered by definitions are ultrasonics, underwater sound, recording and reproducing, shock and vibration, and acoustical units. It represents a joint effort by the Acoustical Society of America and the Institute of Radio Engineers.

Completion of this Standard culminates four years of work involving approval of a number of technical organizations, including, among many others, physics groups, radio-Tv manufacturers, and the SMPTE.

Shrunken Film Restorative

A process has been developed by which motion picture negatives stored for use in vaults and considered unusable because of excess shrinkage, may be reconditioned to permit making commercially acceptable prints on continuous contact-printing equipment. The treatment is called "Peer-Renu," patent pending. Peerless Film Processing Corp. is offering this treatment at 130 West 46th Street, New York 36, N. Y., and at its West Coast Branch, 959 Seward Street, Hollywood 38, Calif. The company offers without charge its advisory service on the possibility of restoring any such negatives to economic usefulness.

Extensive tests in which the company had the cooperation of skilled observers from outside its organization indicate that "Peer-Renu" will reduce the amount of shrinkage by 25% to 40%. Where this brings the shrinkage down to 1% or less, commercially acceptable prints can usually be made on a continuous printer.

ARCLAMP GENERATOR

(*Continued from page* 16)

treat from the thrilling wonderland of electromagnetism. In one of his personal letters he wrote:

"I am busy just now on electro-magnetism, and think I have got hold of a good thing, but can't say. It may be a weed instead of a fish that after all my labor I may at last pull up." Whatever may be said about intuition, Faraday *knew* that by some manner or means magnetism *could be* changed into electricity. And luck was on his side!

Faraday Constructs a Generator

On 18 October, 1831, success came within Faraday's grasp. He wound 220 feet of copper wire into a coil to form a hollow cylinder. The end wires of the coil were connected to a galvanometer, a very sensitive current-detecting meter. He then thrust a bar maget 8½ inches long into the hollow coil. The galvanometer needle jiggled. Quickly, he drew

the magnet out. Again the needle moved. Magnetism had been converted into electricity *by movement*! It became at once clear that in order to induce an electric current the coil must "cut" the "magnetic lines of force."

But even this was not enough for Faraday. Scientist that he was, he had to make sure beyond all possibility of doubt that his induced electricity was the same as that produced by the voltaic pile. So on October 30, 1831, he constructed a simple generator.

Faraday's "electrical machine" bore little resemblance to the mighty generators of today, but all the essential parts were there. It consisted of a horseshoe magnet between the poles of which revolved a large copper disc fitted with an axle and a crank. A strip of copper resting upon the edge of the disc and another upon the axle served as brushes to collect the current. When the brushes were connected to a galvanometer and the disc rotated by means of the crank, the needle was deflected to one side. A steady electric current was thus produced by a magnetic field and a rotating disc "armature."

The Magneto—the Dynamo

Substitute for the copper disc an armature consisting of several interconnected coils of wire wound on an iron core, and introduce a cylindrical commutator of separate copper segments to which the armature coils are tapped, and upon which the brushes may rest for the efficient collection of current, and we have the *magneto*, a type of D.C. generator used in certain kinds of testing and telephone hookups, and formerly for automobile ignition.

Now replace the permanent magnets of the magneto by electromagnets appropriately energized by D.C., and we have the *dynamo*. Electromagnets furnish a more powerful magnetic field than permanent magnets, and hence induce stronger currents in the armature.

A single A.C.-to-D.C. *rectifier* unit, no matter whether tube or stack, can serve only *one* arc-lamp. If two arcs are supplied from a single rectifier cabinet, it is a certainty that two separate and independent units are housed by the rectifier cabinet.

This state of affairs poses no particular disadvantage. A positive advantage lies in the fact that the falling-voltage electrical characteristics of each rectifier unit make the use of current-wasting ballast rheostats unnecessary.

The term "falling-voltage characteristic" means that as the arc current increases the voltage of the current source falls off. When this is the case, a balance is quickly attained in which the arc burns steadily with constant voltage drop (voltage across the arc), the current neither increasing nor decreasing.

One of the peculiarities of the carbon arc is that, like most gaseous electrical conductors, its resistance decreases with increasing current. This leads to a further increase of current, still lower resistance of the arc, etc.—a vicious cycle in

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which all arc stability is lost. In a short time either the current-supply unit will burn up, if not protected by fuses or circuit-breakers, or else the carbons will flame along their length and spindle. The carbon consumption will be very rapid, and the screen illumination exceedingly poor.

There are also arclamp generators having the same falling-voltage characteristics as rectifiers. As each arc requires a separate generator of this type (just as each arc requires a separate rectifier), and also because motor-generator sets are expensive, this type of dynamo, although very efficient, has not proved popular. Moreover, the shorting-out switches and special changeover techniques developed in a not-too-successful attempt to permit two arcs connected in series to be supplied by only one of these falling-volt generators have not gained general projectionist acceptance.

Multiple-Arc Generator

The standard type of generator for theater projection is, instead, a "multiple-arc" generator, so called because it is especially designed for the operation of several arcs in parallel. The multiple-arc dynamo maintains over a wide range of load a *constant*, instead of a falling-voltage, characteristic. This makes possible the burning of two arcs at once, as is necessary during the changeover period.

A constant-voltage characteristic of the source, however, makes the burning of arc-lights very unstable, as previously explained. An arc demands the use of current supplied with a falling-volt characteristic. So when the multiple-arc dynamo is used as the current source, ballast resistance must be inserted in series with the arc—even though the voltage-drop occasioned by the ballast causes current to be changed into heat and wasted. Perhaps the following explanation of the action of the ballast rheostat will make the matter clearer.

Effect of "Arc-Drop"

Were ballast rheostats not used, the "arc-drop" as measured in volts would become increasingly lower (proportionately to the current) because the resistance of the arc decreases with increasing current. With a lower arc-drop more current (amperes) would pass. The carbons would spindle, and the generator would soon be overloaded to capacity if not protected by fuses. When a certain stage of overload is reached, the generator, if not destroyed by overheating, would lose its field magnetism and cease generating current.

When a ballast rheostat is connected in series with the arc, the tendency of the arc to consume more and more current simply causes an increasingly large current to flow through the ballast. Now, the ballast is a practically *fixed* resistance; *i.e.*, it is a resistance of just so many ohms regardless of the current flowing through it. When increased current flows through the ballast, its voltage-drop increases while arc-drop decreases. As a result, the current in the circuit tends to drop. Decreased current increases arc-drop and decreases ballast-drop. With a decrease in ballast-drop, the arc then gets more current, and the process is repeated.

Actually, all these increases and decreases do not follow one another in succession, but occur simultaneously to establish a perfect balance.

Ballast Resistance Important

It has sometimes happened that projectionists, in an effort to "step up" the light, have cut out too much of the ballast resistance. Even when the correct carbon trims are employed, too little ballast results in an unsteady light and faulty feeding of the carbons. The only remedies are to go back to the smaller trim and restore the ballast, or to obtain a generator having higher output voltage and current capacity.

A minor function which the ballast admirably serves is to absorb the "shock" when an arc is struck. Ballast resistors also permit two arcs powered by the same generator to be burned simultaneously for as long as 5 or 10 minutes without overheating the generator.

Whether a generator is a falling-voltage or a constant-voltage machine depends upon the windings of the field electromagnets. There are four general types of field hookups, namely, series, shunt, compound, and separately excited.

[TO BE CONTINUED]

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TOP-GROSSING Film Productions of 1951

The First 4 and

From VARIETY ANNUAL, Jan. 3, 1952

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2. "Show Boat" . . . . . TECHNICOLOR . . MGM
3. "An American in Paris" . . . TECHNICOLOR . . MGM
4. "The Great Caruso" . . . . . TECHNICOLOR . . MGM

From SHOWMEN'S TRADE REVIEW, Dec. 22, 1951

1. "King Solomon's Mines" . . . TECHNICOLOR . . MGM
2. "Show Boat" . . . . . TECHNICOLOR . . MGM
3. "Samson and Delilah" . . . . TECHNICOLOR Paramount
4. "I'd Climb the Highest Mountain" TECHNICOLOR 20th-Fox

5 out of First 7

From MOTION PICTURE DAILY and MOTION PICTURE HERALD, Jan. 4, 1952

"An American in Paris" . . . TECHNICOLOR . . MGM
"David and Bathsheba" . . . TECHNICOLOR . 20th-Fox
"The Great Caruso" . . . . . TECHNICOLOR . . MGM
"King Solomon's Mines" . . . TECHNICOLOR . . MGM
"Show Boat" . . . . . TECHNICOLOR . . MGM

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